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WENDEROTH, LIND & PONACK, L.L.P.
2033 K STREET N. W.
SUITE 800
WASHINGTON, DC 20006-1021

EXAMINER	
BELL, BRUCE F	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/525,242	LORENTSEN ET AL.	
	Examiner	Art Unit	
	Bruce F. Bell	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 31-62 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 31-62 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 22 February 2005 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 2/22/05.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 32-34, 37-39, 40-44, 47, 49, 50, 59, 61 and 62 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a cooling system and temperature regulation, internal cooling circuit of a heat pipe, finely dispersed alumina being fed, teeth being10-20 cm wide, teeth being oriented 1-5 ^{0}, length of teeth being more than 100 cm, anodes and cathodes being smoothened/rounded "to avoid localized area of high current density at anodes, added alumina efficiently is distributed around the anode, respectively does not reasonably provide enablement for heat exchange and/or heat recovery, means of water cooling or other liquid coolants by gas cooling, where the alumina feed has as fine particulates as possible, and very small batches, that the angle of the teeth is between 1-2 ^{0}, that the anode and grooves are rounded to give a uniform flow characteristic and current density, that the anode is shaped to set up a circulation pattern that distributes fresh electrolyte to all parts of the cell, that the cell is insulated to run the cell thermally in balance with reduced inter polar distance compared with Hall-Heroult cells, and that the anode is totally immersed in the electrolyte to achieve sufficient electrolyte flow and thermal balance in the cell, respectively. The specification does not enable any person

skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims.

The above embodiments in the instant claims are not commensurate in scope with those embodiments presented in applicants instant specification. Any of the embodiments in the instant claims which were presented in the original claims filed with the application may be properly inserted into the instant specification to overcome the above rejection. Any new aspect of the invention found in the new claims and not in the original claims if inserted into the specification, will be considered by the examiner to be new matter in the next office action.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 31-34, 37-39, 40-47, 49, 50, 59, 61 and 62 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 31 is vague and indefinite with respect to the phrase "between the electrodes (1) and (2) and between and over the anode(s) (1). Does applicant mean between the cathode and the anode and over the anodes? Applicant is requested to keep the terms consistent, since cathode (2) and anodes (1) have already been established and the use of the term "electrodes (1) and (2) are not consistent with the rest of the instant claim.

Claims 32-34, 37-39, 40, 42, 44-47, 49, 50, 56, 61 and 62 are vague and indefinite with respect to what attributes applicants are attempting to instantly claim since each of the dependent limitations do not find support in the instant specification as set forth.

Claim 32 is further vague and indefinite with respect to how the anodes and/or anode connection are structurally connected to be cooled to provide heat exchange and/or heat recovery.

Claim 33 is vague and indefinite with respect to how the anodes and/or anode connections are cooled by means of water cooling or other liquid coolants, since the anodes are immersed in the molten electrolyte and the examiner can not find any support or figure showing how this is accomplished.

Claim 34 is vague and indefinite with respect to "the feeding of alumina to the cell". There is no antecedent basis for "the feeding of alumina to the cell" found in the claim on which this claim depends. Further, it is unclear as to what the particle size of the particulates is from the instant claim as set forth. Further, it is unclear as to whether very small batches and semi-continuous means the same thing from the instant claim as set forth.

Claim 37 is vague and indefinite with respect to the shape of the "teeth" as set forth in the instant claim. It is unclear to the examiner what is meant by "separated by 1-3 cm deep and 1-3 cm wide grooves. It appears to the examiner that the separation between the teeth is a groove but if the teeth are separated and it is a groove, what is the 1-3 cm depth? Does applicant mean the height from the tip of one tooth to then end

of the groove or does applicant mean that the tooth is 1-3 cm deep? Clarification and/or correction is requested.

Claims 38-40 depend on instant claim 37 and therefore have the same defect.

Claim 42 is vague and indefinite with respect to what the shape is that creates a circulation pattern that distributes fresh electrolyte to all parts of the cell. An apparatus relies on features and therefore, it is unclear as to what the shape is that constitutes this circulation pattern to distribute fresh electrolyte to all parts of the cell. Applicant is reminded that the claims can be read in light of the specification but the limitations can not be read into the claims. Therefore, the specific design structure of the anode is needed.

Claim 44 is vague and indefinite with respect to how the structure of the electrowinning cell is being further limited, since the anode already exists in the cell of the claim on which this claim depends. It appears that applicant is depending on the manner in which the cell is to be operated which in an apparatus claim does not further limit the invention. What structural attribute of the anode when totally immersed in the electrolyte allows the electrolyte to achieve sufficient electrolyte flow and thermal balance in the cell?

Claim 45 is further vague and indefinite with respect to the phrase, "in a similar way". It is unclear to the examiner, "what this similar way" is, from the instant claim as set forth.

Claim 46 is vague and indefinite with respect to how the anode clusters are placed with orientation of the grooves so that the produced oxygen in the grooves sets

up an electrolytic flow pattern that facilitates electrolytic flow velocity to obtain uniform distribution of alumina in the cell and not have muck formation. It is unclear from the instant claim at hand how the clusters are oriented to accomplish the flow pattern suggested by the claim. In an apparatus claim, structural details are required to further set forth narrowing or limiting of the apparatus claims. It does not appear that applicants have set forth the apparatus features which would show the orientation being further limited, in such a manner which would show how such anodes are positioned in the molten electrolyte to yield the aforementioned flow patterns.

Claims 47 and 62 are vague and indefinite with respect to how the anode clusters position is optimized with respect to groove orientation and side and center channels to give the necessary alumina mixing and distribution. It is unclear from this claim what the actual orientation of the clusters position is which yields such an effect. In an apparatus claims structural details to accomplish this feat are required to further narrow or limit the claim structurally. This claim as presented does not appear to have accomplished this aspect.

Claim 49 is vague and indefinite with respect to the "oxide" based cermets and ceramics as well as the metal alloys being instantly claimed, since the instant specification sets for cermets and metals but not specifically oxides there of, or alloys, therefore, respectively. The examiner would like to point out that cermets do not have to be oxides.

Claim 56 is vague and indefinite with respect to whether applicant is attempting to claim a method of electrowinning or an electrowinning cell from the instant claim as

set forth. It appears that applicants are instantly claiming a method of stabilizing the cathode by use of a magnetic field, however, apparatus claims are suppose to be set forth in terms of features not methodic steps. Applicant is advised to restructure the claim in view of the additional features to limit the claim on which this claim depends.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 31, 34-37, 42, 45-47, 52, 54-62 are rejected under 35 U.S.C. 102(b) as being anticipated by de Nora et al (6540887).

De Nora et al disclose an aluminum electrowinning cell with oxygen evolving anodes. See title. The cell for the electrowinning of aluminum has at least one non-carbon metal anode having an electrically conductive metallic structure which is suspended substantially parallel to a facing cathode. The metallic structure comprises a series of parallel horizontal anode members, each having an electrochemically active surface on which during electrolysis oxygen is anodically evolved. The anode members are spaced apart from one another by inter-member gaps forming flow through openings for the circulation of electrolyte driven by the escape of anodically evolved oxygen. The electrolyte may circulate upwardly and/or downwardly in the flow through openings and around the anode structure. See abstract. The anode structure is a series of parallel horizontal anode members, each having an electrochemically active surface

on which during electrolysis oxygen is anodically evolved, the electrochemically active surfaces being in a generally coplanar arrangement to form said active anode surface. The anode members are spaced apart to form longitudinal flow-through openings for the circulation of electrolyte driven by the fast escape of anodically evolved oxygen. See col. 2, lines 60-67. Depending on the cell configuration some or all of the flow through openings may serve for the flow of alumina rich electrolyte to an electrolysis zone between the anode and the cathode and/or for the flow of alumina depleted electrolyte away from the electrolysis zone. When the anode surface is horizontal or inclined these flows are ascending and descending. See col. 3, lines 1-7. The anode members may be spaced apart blades, bars, rods or wires. The bars, rods or wires may have a rectangular or circular cross-section or have in cross-section an upper semi-circular part and a flat bottom. The bars, rods or wires may be bell-shape or pear-shape in cross section. Each blade, bar or wire may be in rectilinear or concentric arrangement, each forming a loop to minimize edge effects of the current during use. Each blade, bar, rod or wire may be circular, oval or polygonal, rectangular or square, with rounded corners. See col. 3, lines 44-56. The temperature of conventional cells is 950 to 970 ^{0} C. See col. 6, lines 32-33. The cell may be operated with an operative temperature of the electrolyte below 910 ^{0} C, usually from 730 to 870 ^{0} C. The electrolyte may contain NaF and AlF_3 in a molar ratio NaF/AlF_3 required for the operating temperature of the cell comprised between 1.2 and 2.4. See col. 7, lines 9-13. The inter-member gaps constitute flow through openings for the circulation of electrolyte and the escape of anodically evolve gas released at the electrochemically active surfaces. See col. 8, lines 3-6. The molten

aluminum produced is space apart from the facing anodes by an inter-electrode gap. The baffles are provided upper downwardly converging surfaces and lower upwardly converging surfaces that deflect gaseous oxygen which is anodically produced below the electrochemically active of the anode members and which escapes between the inter member gaps through the foraminate anode structure. The oxygen released above the baffles promotes dissolution of alumina fed into the electrolyte above the downwardly converging surfaces. See col. 11, lines 23-31. An aluminum-wettable cathodic coating can be a slurry applied refractory hard metal coating such as that of a metal boride such as TiB_2. See col. 11, lines 43-50. Above and below the surface of the electrolyte, the sidewalls may be covered with a zinc oxide coating with alumina or zinc aluminate coating. See col. 12, lines 3-6. During cell operation, alumina is fed to the electrolyte over the baffles and the metallic anode structure. The fed alumina is dissolved and distributed from the bottom end of the converging surfaces into the inter electrode gap through the inter member gaps and around edges of the metallic anode structure between the neighboring pairs of anodes or between peripheral anodes and sidewalls. By passing an electric current between anodes and facing cathode cell bottom, oxygen is evolved on the electrochemically active anode surfaces and aluminum is produced which is incorporated into the cathodic molten aluminum. The oxygen evolved from the active surfaces escapes through the inter member gaps and is deflected by the upwardly converging surfaces of baffles. The oxygen escapes from the uppermost ends of the upwardly converging surfaces enhancing dissolution of the alumina fed over the downwardly converging surfaces. See col. 12, lines 12-29. The

electrolyte circulation is generated by the escape of gas released from the active surfaces of the anode members between the inter-member gaps and which is deflected by the upward converging surfaces of the baffles confining the gas and the electrolyte flow between their uppermost edges. See col. 12, lines 38-43. The anodically evolved gas escapes towards the surface of the electrolyte, where as the electrolyte circulation flows down through the downward converging surfaces, through the inter-member gaps and around edges of the metallic anode structure to compensate the depression created by the anodically released gas below the active surfaces of the anode members. The electrolyte circulation draws down into the inter-electrode gap dissolving alumina particles which are fed above the downward converging surfaces. See col. 12, lines 44-54. The uppermost end of the baffles are located below but close to the surface of the electrolyte to increase the turbulence at the electrolyte surface caused by the release of anodically evolved gas. See col. 12, lines 61-64. By guiding and confining anodically evolved oxygen towards the surface of the electrolyte with baffles or other confinement means oxygen is released so close to the surface as to create turbulences above the downwardly converging surfaces promoting dissolution of alumina fed thereabove. See col. 13, lines 1-8.

The prior art of de Nora et al anticipates the applicant's instant invention as set forth above with respect to the instant claims as presented.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 38-41, 48, 49 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Nora et al (6540887) in combination with LaCamera et al (2004/0163967).

De Nora et al is as set forth above in the 35 USC 102 rejection.

De Nora et al does not disclose anode teeth with a V-shape and sloped from 1 to 5^{0} and having teeth that are 10-20 cm wide.

LaCamera et al disclose inert anodes for use in electrolytic aluminum production cells . The inert anodes have sloped bottom surfaces with controlled bubble release angles. The bottom surface is substantially conical with a bubble release angle of up to 30 degrees. The cross sectional size of the inert anodes is also controlled in order to maximize the efficiency of the cells. The inert anodes may be provided in arrays in aluminum production cells in order to achieve commercial cell currents. See abstract. The cathode and inert anode are separated by a distance known as the anode-cathode distance (ACD). The inert anode has an angled bottom surface and includes a lower tip and curved shoulder. The angled bottom surface defines a bubble release angle A which may range up to about 30 degrees, The bubble release angel A may range from 2 to 20 degrees, preferably from 5 to 15 degrees. The angled bottom surface has a conical shape and the bubble release angel A remains substantially constant around the circumference of the bottom surface. See paragraph 0036. Various bubble release angles A were studied in order to determine optimal angles of the bottom surface for

reduced cell voltage and improved operation efficiency. Each anode is made of a cermet . See paragraph 0038. The cathode comprises a pool of aluminum on a TiB_2 plate which is connected to a DC power supply. See paragraph 0039. Optimization of the anode are arranged by design so that gas film resistance produces a linear voltage drop response in the current density ranges of interest. The anodes can be arranged in either hexagonal or square distributions, with uniform and non-uniform spacing. For each anode size being considered, a distribution may be defined which minimizes cell voltage. See paragraph 0058. The inert anode materials are disclosed to be those of metal oxides, nitrates, halide and the like and the oxides can be formed by powder techniques using metal oxides such as nickel, iron, aluminum, zinc and/or cobalt oxides with metal additives or dopants that are pressed and sintered. See paragraphs 0061-0065.

The subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the instant invention was made because even though the prior art of de Nora et al does not disclose the V-shaped design or the sloped angles of the groove, the prior art of LaCamera et al shows that it is known in the art to use such a design, so as to allow better bubble release from the bottom surface of the anode to reduce cell voltage and improve operation efficiency. Therefore, the prior art of de Nora et al in combination with LaCamera et al renders the applicants instant invention as obvious for the reasons cited above.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 48-51are rejected under 35 U.S.C. 103(a) as being unpatentable over de Nora et al (6540887) in combination with Bates et al (6447667).

De Nora et al is as disclosed above in the 35 USC 102 rejection above.

De Nora et al does not disclose the anode be made of a cermet or metal center with a ceramic outer surface.

Bates et al discloses a thermal shock protection for electrolysis cells wherein a cermet anode of an electrolytic cell is protected from thermal shock during start up by coating an outer surface portion of the anode with a coating composition comprising carbon or aluminum or a mixture thereof. See abstract.

The subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the instant invention was made to have used the anode of Bates et al in the de Nora et al device to help protect the cell from thermal shock during start up of the electrolysis cell. Therefore, the prior art of de Nora et al in combination with Bates et al renders the applicants instant invention as obvious for the reasons set forth above.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 31, 32, 36 and 53 are rejected under 35 U.S.C. 102(b) as being anticipated by de Nora et al (2003/0010628).

De Nora et al disclose a ledgeless and crustless cell operation that is achieved by means of a thermal insulation of the sidewalls and top of the electrolysis cell. The insulating cover used on the top of the cell is a composite structure having an inner surface layer of material resistant to fumes from the molten electrolyte, an insulating core and an outer support structure, providing mechanical strength. See paragraphs 0022 and 0023. The cell may comprise means for supply heat between the insulating cover and the surface of the molten electrolyte to prevent cooling leading to the formation of an electrolyte crust when the insulating cover is removed. See paragraph 0025. The cell further may have a means for supplying powdered alumina between the thermal insulating cover and the molten electrolyte surface. The alumina supplying means comprises a device for distributing preheated alumina by spraying or blowing it over the molten electrolyte surface. See paragraph 0025. The feeder device of the invention is arranged to distribute the supplied powdered alumina over all of the molten electrolyte surface from where the alumina dissolves as it enters the electrolyte to maintain an even concentration of dissolved alumina in the circulating electrolyte. See

paragraph 0026. The heat evacuated form the cell with the gas produced during electrolysis and/or the heat conducted by stems feeding current to the active anode structures is used to preheat the stored alumina. The alumina may be preheated while it is introduced into the cell above the molten electrolyte by blowing it with hot gas or a flame. See paragraph 0027. The device further has means for inducing electrolyte circulation by upward lift of oxygen released form the anodes, where the electrolyte circulates towards the molten electrolyte surface and down to the inter electrode gap. These means can include sloped surfaces of the anodes facing sloping cathodes or can induce baffles, funnels or other electrolyte guide members with converging surfaces, arranged above a foraminate anode of open structure comprising a series of vertical through openings for the fast release of anodically produced oxygen and for the down flow of alumina rich electrolyte into the anode cathode gap for electrolysis. The electrolyte circulation system comprises an electrolyte guide member that is arranged above a foraminous anode of open structure having a series of vertical through openings for the rapid escape of anodically produced oxygen and for the down flow of alumina rich electrolyte into the anode cathode gap for electrolysis.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bruce F. Bell whose telephone number is 571-272-1296. The examiner can normally be reached on Monday-Friday 6:30 AM - 3:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BFB
September 10, 2007

Bruce F. Bell
Primary Examiner
Art Unit 1745